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(19)

3

(54) IMPROVEMENTS IN OR RELATING TO TRANSFORMERS AND CIRCUIT ARRANGEMENTS INCORPORATING THE SAME

(71) We, THE PLESSEY COMPANY LIMITED, a British Company of 56 Vicarage Lane, Ilford, Essex. do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to transformers and circuit arrangements in which they are used.

According to the present invention a transformer comprises a ferrite core arrangement having at least two parts which are nested in and separated by the material of a heat sink and a winding which links the said parts.

The said parts may be of similar size and shape and may each comprise a number of ferrite toroids stacked to form an annular core.

The heat sink may be fabricated of aluminium, aluminium alloy or similar suitable material and have spaces or nests therein for receiving the said parts.

The primary and secondary conductors of the winding may be twisted to form a bifilar winding linking the parts of the core.

A transformer constructed in accordance with the present invention may be arranged to operate with core parts of relatively small cross section without overheating and thus a minimum conductor length may be used for the winding which results in a low leakage inductance characteristic. A transformer having this desirable characteristic lends itself for application in communication equipment and one particular application, which will hereinafter be described, is for neutralising purposes in high power transmitters.

An exemplary embodiment of the invention will now be described with reference to the accompanying drawing, in which:

Figure 1A is a somewhat schematic sectional side elevation of a transformer according to the invention;

Fig. 1B is a plan view of the transformer of Fig. 1A, and

Figure 2 is a circuit diagram incorporating a transformer as shown in Figure 1A and 1B.

Referring firstly to Figure 1 a transformer comprises a core having parts defined by two stacks 1 and 2 of ferrite toroids. In this example six toroids are included in each stack. Any number of toroids may be used depending upon their thickness and the particular application in view. The stacks 1 and 2 are nested in spaced apart relationship within an aluminium heat sink 3 having fins 4 which promote heat dissipation. A bifilar winding 5 consisting of twisted primary and secondary conductors, is wound through each of the stacks 1 and 2 to link them. Cores of relatively small cross section may be used for a transformer as just above described without overheating and thus the length of wire required for a given inductance may be kept as small as possible and thus the leakage inductance may be reduced to a minimum. One particular application for a transformer having this desirable characteristic is for neutralising in high power transmitters.

Neutralising is frequently employed in high power transmitters to minimise the effects of unwanted coupling between the anode and grid electrodes of a high power amplifier stage which results from valve inter-electrode capacity. The methods of neutralising most commonly employed utilise tuned circuits at the grid or at the anode of an amplifier stage to effect a phase reversal of a signal obtained by capacitive coupling from the output of the stage.

In one application of the present inven-

tion however it is proposed to derive from the anode of a valve by capacitive coupling a signal which is injected into the grid of the valve via a wide band ferrite transformer, fabricated according to the present invention, which provides the necessary phase reversal as required for neutralising purposes.

Turning now to Figure 2 a valve 6 utilised in the high power stage of a transmitter has a load inductance 7 and a capacitive feed 8 to the next stage. The primary winding 9 of a neutralising transformer 10 is fed from the anode of the valve 6 via an adjustable capacitor 11 and the secondary winding 12 of the transformer is arranged to feed back to the grid of the valve 6 via a blocking capacitor 13, the grid of the valve being fed with an input signal via an input capacitor 14.

One advantage of this method of neutralising is that it is independent of the main circuit associated with the transmitter and provides wide band neutralising independently of the state of tuning of the transmitter. The wide band neutralising as aforesaid, is facilitated by reason of the low leakage inductance which is obtainable with a transformer according to the invention. Thus consistent neutralising for a large operational frequency range may be provided allowing freedom in design of main circuits. A further advantage with this method of neutralising is that circuits incorporating this kind of neutralising are free from the parasitic oscillations which are often associated with other neutralising circuits. It will be appreciated that this is only one application of the transformer in the radio communication art and that the principle of the transformer may be applied in other circuits without departing from the scope of the invention.

WHAT WE CLAIM IS:—

1. A transformer comprising a ferrite core arrangement having at least two parts, which are nested in and separated by the material of a heat sink and a winding which links the said parts.

2. A transformer as claimed in claim 1 wherein the parts are generally annular in shape.

3. A transformer as claimed in claim 2 wherein the parts of the core are of similar size and shape and wherein each comprises a stack of ferrite toroids.

4. A transformer as claimed in any preceding claim wherein the heat sink is fabricated of aluminium or an aluminium alloy.

5. A transformer as claimed in any preceding claim wherein the winding comprises primary and secondary conductors twisted to form a bifilar winding.

6. In a neutralising circuit, a transformer as claimed in any preceding claim.

7. In a transmitter, a neutralising circuit as claimed in claim 6.

8. A neutralising transformer substantially as hereinbefore described with reference to the accompanying drawings.

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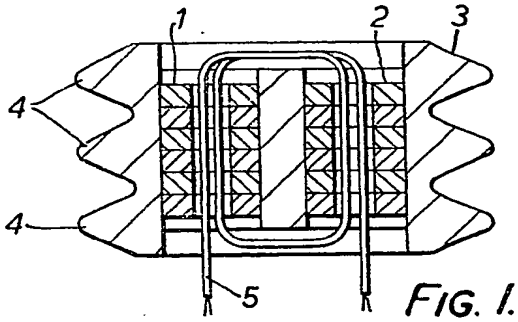

FIG. 1.A

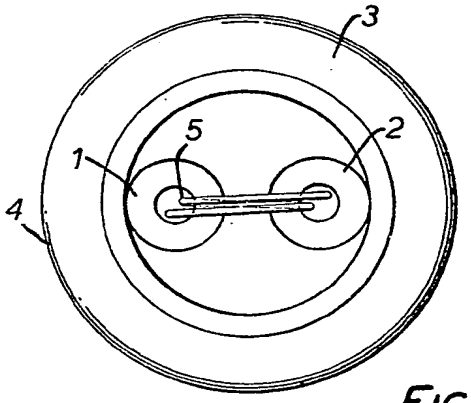

FIG 1B

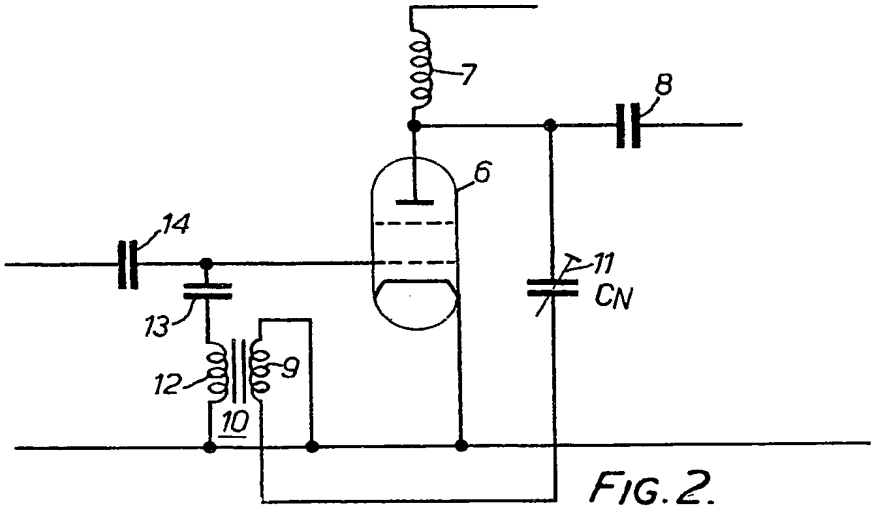

FIG. 2.